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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,415	03/26/2004	Liang Liu		2618

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EXAMINER	
SANTIAGO, MARICELI	

ART UNIT	PAPER NUMBER
2879	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/811,415	LIU ET AL.	
	Examiner	Art Unit	
	Mariceli Santiago	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 13-17* is/are rejected.

7)☒ Claim(s) *9-12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The Amendment, filed on June 13, 2007, has been entered and acknowledged by the Examiner.

Claims 1-17 are pending in the instant application.

Terminal Disclaimer

The terminal disclaimer filed on June 25, 2007 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent 7,115,013 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-6, 13 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (2003/0027478 A1) in view of Dai et al. (US 6,232,706).

Regarding claim 1, Park discloses a method for making a carbon nanotube-based field emission device comprising the steps of providing a substrate (18) having a surface, forming a carbon nanotube array (17) extending from a selected area of the surface (Paragraph [0028]), forming a cathode electrode (15) on a top of the carbon nanotube array, and removing the substrate (18) so as to expose the bottom surface of the carbon nanotube array (Fig. 3C), so that the bottom surface of the carbon nanotube array is thereby configured for acting as an

electron emitting surface of the carbon nanotube-based field emission device. Although Park appears to show a substrate having a flat surface (Fig. 3B), Park fails to explicitly state that the substrate has a flat surface and the CNT's array has a flat bottom surface corresponding to the flat surface of the substrate. Park discloses directly growing the CNT's array over the surface of the substrate (Paragraph [0028]), however, fails to disclose forming a catalyst layer on a selected area of the flat surface of the substrate.

In the same field of endeavor, Dai discloses a method of growing self-aligned CNT's array over the surface of a smooth[1] substrate (22, Column 2, lines 30-31) by providing a catalyst layer (26) on a selected area of the smooth surface of the substrate. The disclosed method exemplifies the manufacture of CNTs in a confined patterned region, which allows for an accurate control of the size, shape, and distribution of the bundles on the substrate surface (Column 4, lines 31-35). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the step of forming a CNT's array by growing the CNTs from a catalyst layer formed over the smooth surface of a substrate as disclosed by Dai in the method of Park in order to manufacture an array of CNTs in a confined patterned region, which allows for an accurate control of the size, shape, and distribution of the bundles on the substrate surface. Moreover, given that the nanotubes of the combined references to Park-Dai are grown from a surface of the substrate, the bottom surface of the CNT's array has the same bottom profile surface of the substrate, (i.e. a smooth surface).

The combined references to Park-Dai fails to exemplify the limitation of forming a single cathode electrode having a continuous flat surface on a top of the carbon nanotube array, instead Park discloses forming multiple column cathodes (15). Park further acknowledges that the size of the substrate (18) is related to the number of conductive columns the CNTs are

[1] Smooth definition is as generally flat. See definition at *dictionary.com*

installed, and the substrate (18) is further taught to be a continuous substrate. It is considered within the capabilities of one skilled in the art to use the stamping technique for multiple cathode columns as disclosed in Park for use in stamping a single continuous cathode component, since such modification would be considered to have a reasonable expectation of success for either of the cathode arrangements (single or multiple). Moreover, Park discloses the multiple column cathodes (15) having their tops at the same level, accordingly, it is considered within the teachings of Park to substantially provide a the cathode components with a continuous flat surface. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to use the stamping technique as disclosed by Park for stamping a single cathode electrode having a continuous flat surface, to achieve the claimed invention given its reasonable expectation of success.

Regarding claim 3, Dai further discloses a method wherein the substrate is made of heatproof glass, silicon, or silicon oxide (Column 5, lines 51-55).

Regarding claim 4-5, the combination Park-Dai is silent in regards to the limitation of wherein a thickness of the substrate is in the range from 1 micron to 1000 microns, or in the range from 10 microns to 200 microns. However, it is considered within the capabilities of one skilled in the art the optimization of a workable range as an obvious matter of design engineering, as long as the mechanical stability and strength of the substrate is maintained. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate a substrate thickness within the claimed, since such modification is considered within the level of skills in the art.

Regarding claim 6, Dai further discloses a method wherein a thickness of the catalyst layer is in the range from 1 nanometer to 10 nanometers (Column 2, lines 52-53).

Regarding claim 13, Dai discloses a method for making a carbon nanotube-based field emission device comprising steps of providing a substrate having a surface, forming a carbon nanotube array extending from a selected area of the surface, the carbon nanotube array, having a bottom surface corresponding to the flat surface of the substrate, depositing a layer of metallic material on a top of the carbon nanotube array, and removing the substrate to expose the bottom surface of the carbon nanotube array so that the carbon nanotube array is thereby configured for acting as an electron emitting surface of the carbon nanotube-based field emission device. Although Park appears to show a substrate having a flat surface (Fig. 3B), Park fails to explicitly state that the substrate has a flat surface and the CNT's array has a flat bottom surface corresponding to the flat surface of the substrate and that the substrate is insulative. Park discloses directly growing the CNT's array over the surface of the substrate (Paragraph [0028]), however, fails to disclose forming a catalyst layer on a selected area of the flat surface of the substrate.

In the same field of endeavor, Dai discloses a method of growing self-aligned CNT's array over the surface of a smooth[2] insulative substrate (22, Column 2, lines 30-31) by providing a catalyst layer (26) on a selected area of the smooth surface of the insulative substrate. The disclosed method exemplifies the manufacture of CNTs in a confined patterned region, which allows for an accurate control of the size, shape, and distribution of the bundles on the substrate surface (Column 4, lines 31-35), moreover, Park further exemplifies the use of an insulative substrate (i.e., silicon, ceramic, Column 5, lines 51-55). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the step of forming a CNT's array by growing the CNTs from a catalyst layer formed over the smooth surface of a substrate as disclosed by Dai in the method of Park in order to manufacture an

[2] Smooth definition is as generally flat. See definition at *dictionary.com*

array of CNTs in a confined patterned region, which allows for an accurate control of the size, shape, and distribution of the bundles on the substrate surface. Furthermore, given that the nanotubes of the combined references to Park-Dai are grown from a surface of the substrate, the bottom surface of the CNT's array has the same bottom profile surface of the substrate, (i.e. a smooth surface).

The combined references to Park-Dai fails to exemplify the limitation of forming a single cathode electrode having a continuous flat surface on a top of the carbon nanotube array, instead Park discloses forming multiple column cathodes (15). Park further acknowledges that the size of the substrate (18) is related to the number of conductive columns the CNTs are installed, and the substrate (18) is further taught to be a continuous substrate. It is considered within the capabilities of one skilled in the art to use the stamping technique for multiple cathode columns as disclosed in Park for use in stamping a single continuous cathode component, since such modification would be considered to have a reasonable expectation of success for either of the cathode arrangements (single or multiple). Moreover, Park discloses the multiple column cathodes (15) having their tops at the same level, accordingly, it is considered within the teachings of Park to substantially provide a the cathode components with a continuous flat surface. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to use the stamping technique as disclosed by Park for stamping a single cathode electrode having a continuous flat surface, to achieve the claimed invention given its reasonable expectation of success.

Regarding claim 15, Dai further discloses a method wherein the substrate is made of heatproof glass, silicon, or silicon oxide (Column 5, lines 51-55).

Regarding claim 16, Dai further discloses the use of a smooth surface substrate. The recitation "is polished" is directed to a process limitation, patentability of a claim to a product

does not rest merely on the difference in the method by which the product is made. Rather, is the product itself which must be new and not obvious. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). Accordingly, the structure implied by the process steps would be considered for assessing the patentability of product-by-process claims over the prior art (see MPEP 2113).

Regarding claim 17, Dai further discloses a method wherein the flat continuous surface of the cathode is opposite to the substrate.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (2003/0027478 A1) in view of Dai et al. (US 6,232,706), and further in view of Jin (US 6,286,226).

Regarding claim 7, the references to Park-Dai fail to exemplify the limitation of the substrate being removed by an etching process. However, in the same field of endeavor, Jin discloses a method of transferring nanotubes from a temporary substrate to a permanent substrate, wherein the temporary substrate is removed by either peeling of or etching away the substrate, accordingly, Jin acknowledges the art recognized equivalence of both manufacturing steps, and it would be considered within the capabilities of one skilled in the art to selected one of either equivalents as an obvious matter of design engineering. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate an step of removing the substrate by an etching process as taught by Jin in the method of Park-Dai, as an obvious matter of design engineering.

Allowable Subject Matter

Claims 9-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant's arguments with respect to claims 1-8 and 13-17 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mariceli Santiago whose telephone number is (571) 272-2464. The examiner can normally be reached on Monday-Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (571) 272-2457. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mariceli Santiago
Primary Examiner
Art Unit 2879